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ABSTRACT

A study examined language learners' ability to integrate information from sentence contexts and semantic decomposition in interpreting novel kanji compounds (i.e., words consisting of two or more Japanese characters). Subjects, 59 English-speaking college students learning Japanese, inferred the meanings of 72 unknown compounds consisting of familiar kanji characters under 3 conditions. Overall, students were more likely to obtain correct answers when they had kanji compounds within sentence contexts than when they received either compounds in isolation or sentences with target words blanked out. Further analysis, however, indicated considerable individual differences among students in the information to which they pay attention. In addition, inferring word meanings from context required a different ability from the ability to use information from word elements. Findings suggest that (1) learning word meanings from multiple information sources is more advantageous than learning from a single source; (2) contextual information and information from word components are qualitatively different; and (3) language learners show individual differences in their choice of information when multiple sources are available. (Contains 38 references, 3 notes, and 8 tables of data.) (Author/RS)

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Integration of Information from Context and Semantic Decomposition in Learning New Words

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Abstract

This study examined language learners' ability to integrate information from sentence contexts and semantic decomposition in interpreting novel kanji compounds (i.e., words consisting of two or more Chinese characters). Fifty-nine English-speaking college students learning Japanese inferred the meanings of 72 unknown compounds consisting of familiar kanji characters under three conditions. Overall, students are more likely to obtain correct answers when they had kanji compounds within sentence contexts than when they receive either compounds in isolation or sentences with target words blanked out. Further analysis, however, indicates considerable individual differences among students in the information to which they pay attention. In addition, inferring word meanings from context requires a different ability from the ability to use information from word elements. These results suggest that (a) learning word meanings from multiple information sources is more advantageous than learning from a single source, (b) contextual information and information from word components are qualitatively different, and (c) language learners show individual differences in their choice of information when multiple sources are available.

As learners improve their proficiency in a foreign language, written texts become an important source of learning. The importance of vocabulary knowledge in skilled reading has been well-established (Anderson & Freebody, 1981). Insufficient vocabulary knowledge is detrimental to reading not only in one's first language (Shefelbine, 1990) but also in a second language (Haynes, 1993; Haynes & Bloch, 1993).

For many learners of Japanese as a foreign language (JFL), the major obstacle to learning from written texts is kanji compounds (i.e., words consisting of two or more Chinese characters) which constitute a crucial part of vocabulary in written Japanese.[1] While students' knowledge of kanji plays an important role in learning from written materials, many JFL learners, particularly learners from alphabetic languages, appear to have trouble handling kanji words. One reason is that many kanji compounds are not semantically transparent, that is, the meanings of component characters do not necessarily make a direct contribution to the meaning of the whole word (e.g., the combination of "blue" and "spring" is "adolescence"). Because of this semantic opaqueness, students are not always successful in deriving the meaning of a novel kanji compound, even if they know the basic meanings of individual characters. Teachers of Japanese, who already know word meanings, often overestimate the semantic transparency of kanji compounds and tend to assume that once students learn a character in a certain context, they should be able to use their knowledge of that character when learning another word containing it. Unfortunately, this is not always the case.

Another vocabulary problem faced by advanced foreign language learners is that they need to learn too many low-frequency words that are rarely taught in class. Because of this, practitioners and researchers argue that teaching advanced learners strategies for handling unknown words on their own is more important than teaching them the words themselves (Kang & Golden, 1994; Nation, 1990). There has been a growing interest in investigating second language vocabulary learning, and researchers have started to pay attention to the roles of semantic decomposition (i.e., an analysis of the semantic contribution of the word components to the meaning of the whole word) and surrounding contexts in inferring of meanings of unknown words.

Learning word meanings from context has been extensively documented in first language (L1) acquisition research (Jenkins, Motlock, & Slocum, 1989; Herman, Anderson, Pearson, & Nagy,

1987; Nagy, Anderson, & Herman, 1987; McKeown, 1985; Sternberg, 1987; Shu, Anderson, Zhang, 1995). Second language (L2) research suggests that foreign language learners are able to use the contextual strategy without any explicit instruction (Dubin & Olshtain, 1993; Dupuy & Krashen, 1993; Ellis, 1994; Huckin & Bloch, 1993; Krashen, 1989, 1993; Li, 1988; Mondoria & Wit-de Boer, 1991), or after being instructed to do so (Huckin & Jin, 1986) when they encounter unfamiliar words while reading.

Deriving the meanings of new words through an analysis of internal word structures has also been widely investigated. Studies have shown that both young readers (Freyd & Baron, 1982; Hancin-Bhatt & Nagy, 1994; Nagy, Diakidoy, & Anderson, 1993; Nagy, Anderson, Schommer, Scott, & Stallman, 1989; Tyler & Nagy, 1989, 1990; Wysocki & Jenkins, 1987) and adult second language learners (Bensoussan & Laufer, 1984; Huckin & Bloch, 1993; Huckin & Jin, 1986; Holmes & Ramos, 1993) use information from word roots and suffixes to obtain the meanings of unknown English derivatives or cognates. In addition, instructional research suggests that explicit root-word instruction facilitates children's abilities to derive the correct meanings of morphologically transparent words (Levin, Carney, & Pressley, 1988; White, Power, & White, 1989).

Neither learning from context nor semantic decomposition, however, accounts for a large portion of students' vocabulary growth by itself. This is partly because information from a single source is not enough to determine the meaning of an unknown word. It is often pointed out that context does not provide sufficient information for low-frequency words that tend to have a narrower range of meaning than high-frequency words (Schatz & Baldwin, 1986). Likewise, information from word roots and suffixes is often unreliable or misleading (Nation, 1990).

Although neither context nor word components may provide sufficient information by itself, these two sources of information may work together to make word meaning clearer. Nagy and Anderson (1984) argue that "while context is often not sufficient to determine the meaning of an unfamiliar word, it may provide enough information to permit a guess at the appropriate meaning of a word whose semantic content is partially determined by its morphology" (p. 327). The implication of their argument is that, if combined appropriately, multiple information sources could produce greater gains in learning new words than learning from a single source.

Nevertheless, studies of English-speaking children (Nagy, Anderson, & Herman, 1987; Wysocki & Jenkins, 1987) have not obtained evidence that students combine information from word roots and suffixes and contextual clues in understanding new words better than learning from a single source. A recent cross-cultural study (Shu, Anderson, & Zhang, 1995), however, found a significant interaction between morphological transparency and learning from context only for Chinese children, but not for American children; that is, morphologically transparent words were learned better than opaque words in context among Chinese fifth graders, but such an interaction effect was not found from American children.

Why did the Chinese group show a synergistic effect of morphological information and contextual clues combined, whereas the American children did not? Shu et al. argue that, because children in the two groups demonstrated their ability to derive the meanings of unfamiliar words from context, the discrepancy cannot be accounted for by differences in their general verbal abilities. Rather, they explain that the lack of the interaction between morphological analysis and learning from context and for American children is more likely to be due to linguistic differences in semantic transparency between Chinese words and English derivatives. English derivational morphemes, according to She et al., are straightforwardedly related to the meaning of the whole word, and if students are familiar with word roots and suffixes, the meaning of a derivational word can be easily predicted from word parts.

In contrast, the semantic opaqueness of Chinese words seems to come from the figurative usage of the meanings of word elements. Because the semantic contribution of radicals or the component characters of Chinese words is not always straightforward (e.g., She et al. give an example of the "female" radical in a character that means "a son in law"), learners cannot solely depend on the individual meanings of a word's component parts to determine the meaning of an unfamiliar word, even if they know the basic meanings of the elements. Students may be able to obtain some semantic features shared by similar words through semantic decomposition. However, the vague, broad meanings obtained from the word components may become much clearer when external information from sentences or phrases is combined (Levin, Carney, & Pressley, 1988; Nagy & Anderson, 1984).

If the semantic transparency of English derivatives makes it difficult to obtain an additive effect of learning from context and morphological analysis, it is a logographic language, particularly with kanji words, which enables us to demonstrate English-speaking students' ability to integrate information. This motivates us to examine English-speaking students learning Japanese.

As in Chinese words or characters, the meanings of component characters of a kanji compound are not directly related to the meaning of the whole word (e.g., the combination of "blue" and "spring" is "adolescence," the combination of "blue" and "spring" is "adolescence"). Hence, knowing the basic meanings of individual characters does not guarantee successful inferences. To interpret novel compounds correctly using information provided by component characters, students must speculate on the figurative usage of the meanings of individual characters which is often culturally-bound. If they are not familiar with the metaphoric or conventional usage of kanji characters in Japanese or apply their L1 specific word knowledge to the structures of kanji compounds, they are likely to produce wrong guesses. Therefore, external contextual clues are expected to compensate for the insufficiency of the internal semantic clues of novel compounds and help learners to obtain the meanings which are compatible with both the meanings of component characters and surrounding context.

Goals of the Present Study

The primary goal of the present study is to demonstrate English-speaking students' abilities to integrate information from component characters and surrounding contexts in interpreting novel kanji compounds consisting of familiar component characters. A second goal is to examine how the ability to infer word meanings from context is related to the ability to analyze the internal structures of unknown words. Lastly, it examines the relationship between students' ability to integrate information and their language proficiency.

To examine the information to which English-speaking learners of Japanese pay attention when multiple information sources are available, this study used a multiple-choice test asking students to infer the meanings of novel compounds consisting of familiar characters under three conditions: (a) the condition under which they receive target kanji compounds in isolation; (b) the condition in which they receive only contextual information; and (c) the condition in which they receive both information

from word parts and contextual information. The prediction was that students would be more likely to obtain the correct answers when they received the two information sources than when they received a single source.

Method

Participants

Sixty-one undergraduate and graduate students who had enrolled in the intermediate or pre-advanced courses in Japanese at the University of Illinois at Urbana-Champaign (UIUC) participated in this study in the spring of 1996. Two students were eliminated from data analyses: One is a Chinese student who had received high school education in her home country and so had a good working knowledge of compounding in the character system. The other was an American student who answered randomly. Hence, data from 59 students remained for use in the analysis. The participants had received lower school education in the United States and had had a minimum of three semesters of Japanese instruction at the time they participated in the study. Their participation in this study was voluntary, and they were paid on completion of the tasks.

Target Words

The target words used in this study were 72 novel kanji compounds consisting of characters which were familiar to learners of Japanese at the intermediate or upper levels. The target compounds were carefully selected so as to represent kanji compounds which were not semantically transparent. The selection procedure was as follows. First, as candidates for component characters, 80 high-frequency kanji characters were chosen from lists of the kanji characters which were taught during the first three semesters of Japanese at UIUC. Then 179 compounds consisting of two or more of the 80 characters were selected to make the pool of candidates for the target compounds.

The familiarity of the 179 candidate compounds was checked by 4 experienced instructors of Japanese: 2 instructors of intermediate courses; and two of pre-advanced courses. In the familiarity test, the instructors were asked to choose one from the following three answers for each compound: (a) I think my students know the word; (b) Some of them may know the word; and (c) I don't think they know the word. The compounds for which more than three of the raters chose the first or

second answers were eliminated from the list of candidates. Thus, the remaining compounds well represented unfamiliar combinations of familiar characters.

Each of the candidate compounds was rated for its semantic transparency on a five-point scale by two graduate students of linguistics who were also experienced instructors of Japanese. The raters were asked how difficult they thought it would be for intermediate and pre-advanced JFL learners to derive the meanings of the compounds from their knowledge of individual characters. Their task was to choose one from the following five answers for each word: (a) Impossible; (b) Difficult; (c) The chances are fifty-fifty; (d) Not difficult; and (d) Easy. Words rated either too difficult or too easy and words showing a large discrepancy between the two raters were eliminated, and 87 compounds remained for the preparation of target sentences.

Target Sentences

For each target compound, a sentence context was prepared. 87 sentences generated by the investigator were revised many times so as to represent sentence contexts that were comprehensible to the target students, and still sounded natural to native speakers without being too strong or too weak. The comprehensibility of the sentences for intermediate JFL learners was checked by an experienced instructor of Japanese, whereas the authenticity was checked by a native speaker of Japanese who had never taught Japanese to non-native speakers. The strength of contextual support of each sentence was controlled in the following way: Three native speakers of Japanese were asked to take a sentence completion test consisting of the 87 sentences each of which had the target word blanked out. For each sentence, the consultants were asked to fill in the blank with a Japanese word that would best complete the sentence. Their responses were scored for the degree of semantic relatedness to the meaning of a target compound on the following five-point scale: (a) no semantic overlap; (b) vaguely related; (c) shared important semantic features; (d) closely related; and (e) identical.

In addition, to minimize cultural biases, the same task was given to two English-speaking graduate students of educational psychology who did not know Japanese. The 87 sentences were carefully translated into English, and the target words were omitted from each sentence. For each sentence, the English-speaking raters were asked to fill in an English word which would best complete the sentence. Their responses were scored using the same rating system. Based on the

consultants' responses and suggestions, problematic sentences were modified or eliminated. After this selection procedure, 78 pairs remained for the preparation of a multiple-choice kanji compound test.

Multiple-Choice Kanji Compounds Test

A multiple-choice kanji compounds test was constructed to examine learners' ability to use information from component characters and sentence contexts. For each pairing of a compound and its corresponding sentence, four types of English answers were prepared: (a) Right Answer, an answer which was compatible with both context and the meaning of component characters (i.e., the meaning of the target compound); (b) Kanji Distracter, an answer which was consistent with the meanings of the component characters of the target word but not with context; (c) Context Distracter, an answer which was consistent with the sentence context but not with the meanings of the component characters; and (d) Wrong Answer, an answer which matched neither the component kanji characters nor the sense of the context.

Kanji Distracters were generated on the basis of the guesses of an American advanced learner of Japanese and of two English-speaking consultants who did not know Japanese. The first consultant was an American graduate student who had completed a pre-advanced course in Japanese in the previous semester. He was shown a list of the target compounds in isolation (without English definitions of characters) and was first asked if he knew the meaning of any word in the list. He reported that he recognized all the kanji characters but did not know the meanings of the words. Then, he was asked to guess the meanings of the target words from his knowledge of kanji. The other English-speaking consultants were given the basic definitions of the component characters in English and were asked to infer the meanings of the compounds. The consultants' responses were carefully considered, and the one which was considered best was used for a Kanji Distracter.

Context Distracters were generated based on responses of two consultants. The first consultant was an American graduate student who had completed a number of advanced courses in Japanese both in the United States and in Japan. He was given the target Japanese sentences with the target words omitted and was asked to fill in each blank with an English word which he thought was compatible with the sense of the sentence. The same task was given to an English-speaking graduate

student who did not know any Japanese. He was given the English translation of the target sentences and was asked to fill in a blank with an English word to make the sentence meaningful. Like Kanji Distracters, the one considered best was used as a Context Distracter.

It should be noted that the correct answers depend on conditions. The correct answers for the Both Condition are Right Answers. For the Kanji Only Condition, the correct answers were both Right Answers and Kanji Distracters. The correct answers for the Context Only Condition were both Right Answers and Context Distracters. Six pairings were eliminated during the preparation of distracters, and 72 pairs remained in the final version of the test materials.

In order to use a repeated-measure's design, the 72 pairs were randomly divided into three sets, each of which consisted of 24 pairs. However, the semantic transparency and the contextual strength of each set of pairs were carefully controlled so that each set would be balanced out. In the test materials, each item set was assigned to one of the following three conditions: (a) the Both Condition in which kanji compounds were presented within the sentences; (b) the Kanji Only Condition in which kanji compounds were presented in isolation; and (c) the Context Only Condition under which sentences with target words omitted were given. The target words and sentences were given in Japanese and the four types of answers were presented in English, as shown in the following examples[2]. Some difficult words in sentence contexts were glossed at the bottom of the page.

1. The Both Condition:

   Kyou no yoru, GES-SHOKU ga aru yo. Yoku mieru you ni yama no ue ni ikou.

(Tonight, we will have a lunar eclipse. Let's go to the top of the hill so we can see well.)

   a. a lunar eclipse (Right Answer)
   b. monthly meal tickets (Kanji Distracter)
   c. fireworks (Context Distracter)
   d. a traffic light (Wrong Answer).

2. The Kanji Only Condition:

   GES-SHOKU ("a month" or "the moon" + "to eat" = "a lunar eclipse")

   a. a lunar eclipse (Right Answer)
   b. monthly meal tickets (Kanji Distracter)

c. fireworks (Context Distracter)

d. a traffic light (Wrong Answer).

3. The Context Only Condition:

Kyou no yoru, _____ ga aru yo. Yoku mieru you ni yama no ue ni ikou.

(Tonight we will have _____. Let's go to the top of the hill so we can see well.)

a. a lunar eclipse (Right Answer)

b. monthly meal tickets (Kanji Distracter)

c. fireworks (Context Distracter)

d. a traffic light (Wrong Answer).

The task given to students in the Both Condition and the Kanji Only Condition was to choose the best meaning of a target kanji compound. In the Context Only Condition, students were instructed to choose the meaning which was most appropriate for the sentence context. The presentation orders of items and the four answer types were randomized within a word set. Nine versions of test materials were constructed so that item sets, conditions, and presentation order of the three conditions would be counter-balanced.

Kanji Pretest

A kanji pretest was prepared to confirm that the individual characters used in the study were known by the target students. In the pretest, students were given 100 characters including the characters used in the target compounds and were asked to check one of the following three answers: (a) I don't know the character; (b) I think I know the character; and (c) I know the character. They were instructed to write anything they knew about the character when they checked either (b) or (c). The subjects were informed that they were not being tested on vocabulary items they had learned in the previous semesters and were told not to guess for words they had never seen before.

Procedure

At the beginning of the spring semester of 1996, the kanji pretest was given in regular class hours to students either enrolling in an intermediate or pre-advanced course in Japanese at UIUC (n=65). Three weeks later, the multiple-choice test was given to the students who volunteered to participate in this study. The participants were randomly assigned one of the nine versions of the multiple-choice

test. The test was given in a large classroom. Before starting the test, students were instructed to consider all choices before deciding which answer was the best and not to skip any question. The instructions were given in English. Students were given as much time as they needed but most of them completed the test within one hour. After completing the test, the participants were asked to answer the questions in a background questionnaire. The instruction given to the participants, sample questions of the kanji compounds test, and the posttest questionnaire are shown in Appendix B.

Results

The kanji pretest showed that none of the characters used in the target compounds was checked for "I don't know the word." Although a few characters were checked for "I think I know the word," overall, the pretest confirmed that all individual characters were at least partially known by the target students.

Table 1 shows the proportion means and the standard deviations of the choices of the four answer types in the three conditions across the two course levels (i.e., the intermediate and pre-advanced levels). There was no significant difference in response patterns between the groups from the two different course levels. For the Both Condition, the proportion of Right Answers (.72) was much higher than that of Kanji Distracters (.14) and that of Context Distracters (.13), which indicates that learners were not often distracted by either Kanji Distracters or Context Distracters when the two information sources were available. In contrast, in the Kanji Only Condition, the proportion for Kanji Distracters was as high as that for Right Answers (.47), indicating that students were distracted by the answers which were consistent with information from component characters when the target kanji compounds were presented in isolation. Similarly, in the Context Only Condition, the proportion for Context Distracters was higher (.35) than it was in the other two conditions, indicating that students were distracted by the answers which were compatible with contextual information when they had only sentence contexts. These results indicate that JFL learners are able to integrate information from morphology and context when the two sources are available.

For the sake of simplicity of presentation, abbreviations will be used to refer to the proportions of each answer type in each condition (Table 2). The proportions of Right Answers will be referred to as "r," that of Kanji Distracters as "k," and that of Context Distracters as "c." The numbers 1 to 3

refer to the three conditions: 1 is the Both Condition, 2 is the Kanji Only Condition, and 3 is the Context Only Condition. Therefore, r1 refers to the proportion of Right Answers in the Both Condition, r2 the proportion of Right Answers in the Kanji Only Condition, r3 the proportion of Right Answers in the Context Only condition. Similarly, k1, k2, and k3 and c1, c2, and c3 refer to the proportions of Kanji and Context Distracters, respectively, in the other conditions.

Table 3 gives the definitions and the interpretations of the integration measures and the non-integration measures used for analysis of this study. r1 is the choice of Right Answers in the Both Condition, indicating that students integrated two information sources and ruled out m1 and c1. For the Kanji Only Condition, r2 (the choice of Right Answers in the Kanji Only Condition) and k2 (the choice of Kanji Distracters) were the correct answers which indicates that students were able to use information from component characters. Therefore, r2, k2, and r2+k2 (the summation of the two) were used as the kanji measures, the measures which indicate learners' ability to use morphological information. For the Context Only Condition, r3, c3, and r3+c3 (the summation of the two) were used as the context measures. Non-integration measures are k1 and c1. k1 indicates students' overreliance on information from kanji even when two information sources were available. Similarly, c1 indicates learners' overreliance on contextual clues, which means that they did not integrate two information sources. Because the distributions of k1 and c1 violated the assumption of normality, scores for k1 and c1 were adjusted using the arcsine transformation method before the subsequent correlation analyses were performed.

Table 4 shows correlations between combinations of integration measures and non-integration measures. This correlation matrix shows that none of the kanji measures (i.e., r2, k2, and r2+k2) and the context measures (i.e., r3, c3, and r3+c3) are significantly correlated, suggesting that the ability to use information from word components and the ability to use sentence contexts to infer the meanings of unfamiliar words are independent. Moreover, k1 (overreliance on kanji) and c1 (overreliance on context) have no correlation, which suggests that the tendency to overrely on word parts does not correspond to overreliance on sentence contexts. These results suggest that (a) different abilities are required to decompose a morphologically complex word and to use context, and

(b) there are individual differences among JFL learners in their choice of information when multiple information sources are available.

Furthermore, r3+c3 is negatively correlated with k1, and r2+k2 with c1 in Table 4. This means that students who are not good at using contextual information tend to overrely on word parts and that their inability to use their knowledge of kanji is associated with dependency on contextual information. This can be interpreted as an attempt by learners to compensate for their weakness with an alternate source of information.

Table 5 gives the definitions and the interpretations of the effect measures used for the subsequent analysis. Both r1-r3 and c1-c3 indicate the effect of information from component characters. r1-r3 is the difference in the proportion of Right Answers between the Both Condition and the Context Only Condition, which indicates how much the proportion of Right Answers increased by having information from kanji additionally. c1-c3 is the difference in the proportion of Context Distracters between the Both Condition and the Context Only Condition, which indicates how much the proportion of Context Distracters decreases by additional information from kanji. Similarly, r1-r2 indicates how much the proportion of Right Answers increased by having contextual information added, and k1-k2 indicates how much the proportion of Kanji Distracters decreased by additional information from context.

Table 6 indicates correlations between the effect measures of the two information sources. In this table, r1-r3 and c1-c3 have a high negative correlation (r=-.81), which means that when there was only contextual information available, students were distracted by Context Distracters, but when they had information from both context and kanji, they chose Right Answers and not Context Distracters. Similarly, r1-r2 and k1-k2 are negatively correlated, which indicates that when students were asked to interpret kanji compounds given in isolation, they were distracted by Kanji Distracters, but sentence contexts prevented them from being distracted by Kanji Distracters.

More importantly, Table 6 indicates that the effect of kanji and that of context are not correlated: c1-c3 (the effect of kanji on the proportion of Context Distracters) and k1-k2 (the effect of context on the proportion of Kanji Distracters) are not correlated (r=.09). Again, these correlations suggest that the ability to use information from word parts and the ability to use contextual clues are independent.

Table 7 shows the correlations between the integration and non-integration measures and students' language proficiency measures for the pre-advanced group. Since the language tests that the intermediate group and the advanced group took were not compatible, the two groups were analyzed separately. The Midterm and Final Exams are the tests which were given to students to measure how much they have learned from the class materials. The Proficiency Test is a standardized test which intends to measure students' overall proficiency in listening comprehension, vocabulary, and reading comprehension. Table 7 indicates that the proficiency measures are highly correlated with the integration measure (r1), and are negatively correlated with the non-integration measure indicating overreliance on component characters (k1). These correlations mean that students who are more proficient in Japanese are more likely to integrate information and are more likely to rule out Kanji Distracters when the two information sources are available.

Table 8 shows correlations between the language proficiency measures and the effects of kanji and context. What is interesting is that the proficiency measures are negatively correlated with k1-k2 (i.e., how much students rule out Kanji Distracter when they have contextual information added) but not with c1-c3 (i.e., how much they could rule out the contextual information when they had information from kanji additionally). This suggests that the ability to use sentence context adequately is confounded with learners' proficiency in Japanese, but whether or not learners gain from kanji characters is not necessarily related to their language proficiency.

Discussion

The results of this study has demonstrated that English-speaking learners of Japanese are generally able to integrate information from component characters and sentence context. Overall, students appear to rule out the answers which are compatible with only the meanings of component characters when they have additional information from sentence contexts, although they are distracted by the kanji answer when the target compounds are presented in isolation. Conversely, when they have only sentence context, they are distracted by the answers which are consistent only with the sentences. However, when they have both context and kanji, they are able to rule out the wrong answers. The present study, therefore, has provided empirical evidence that English-speaking learners' ability to integrate information from both word components and surrounding contexts to

interpret novel kanji compounds. This validates the advantage of multiple information sources in vocabulary learning, which supports the view that teaching learners to pay attention to multiple information sources when learning a new word could lead them to a better understanding of the word meaning.

The results have also shown that guessing word meanings using information from the components requires a different ability from the ability to use contextual information. Correlation analysis indicates that the tendency to overrely on information from component characters when the two information sources are available is not associated with the tendency to overrely on contextual information in the same condition. One interpretation is that foreign language learners show considerable individual differences in their choice of the information to which they pay attention. In fact, the data showed that there were a substantial number of students who overrelied on information from component characters, whereas another group overrelied on contextual information.

Another interpretation for the lack of correlation between kanji measures and context measures is that information from internal word structures and external contextual clues are not equally informative and provide different kinds of information. One characteristic of contextual clues is that they usually provide some information for a broad semantic feature shared by the similar words which fit in a given context. In many cases, however, context does not provide sufficient information for the exact, narrow range of meanings that low-frequency words tend to have (Schatz & Baldwin, 1986). For instance, contextual information may enable the learner to guess "walk," but it does not tell her how the action of walking takes place, such as in "stride" or "tramp." In contrast, as discussed earlier, the meanings of the component characters are often used in a figurative way (e.g., the combination of "moon" and "to eat" is "a lunar eclipse"). Thus, depending on how learners use information from component characters and how imaginative they are, guesses based on information from individual characters may not be related to each other (e.g., from the combination of "moon" and "to eat," the consultants produced various guesses such as "moon eaters," "a meal dedicated to the moon," "monthly meal," and "dorm meal tickets").

The posttest questionnaire revealed that students think that the difficulties of the Kanji Only condition and the Context Only condition came from difference sources. The difficulty of the Context

Only Condition came from the fact that both Right Answers and Context Distracters were possible. In the Kanji Only Condition, on the other hand, the difficulty stemmed from the absence of sentence contexts, not from Right Answers and Kanji Distracters being equally compatible. Presumably, Kanji Distracters were straightforwardly related to the meanings of the component characters the students knew, while Right Answers were either partially related to the meanings of the elements or required additional thought on metaphorical usage of the component characters (e.g., for "tai-i" ("big, large" + "opinion, idea"), the Right Answer "the main idea, the gist" vs. the Kanji Distracter, "a big thought, ambition").

This qualitative difference between contextual information and information from word parts may explain why students' proficiency in Japanese is correlated with how much they gained from sentence context, but not with how much they gained from component characters. As students improve their proficiency in a target language, they are more able to comprehend contextual information. However, learners' ability to speculate upon the figurative usage of kanji characters may not improve in the rate at which they improve their overall proficiency in Japanese. This suggests that language learners' metalinguistic abilities exist independently from their language proficiency.

To discover the relationship between the elements and the meaning of the whole word, students must think about the figurative usage, collocational expressions, the minor meanings of component characters, and other information obtained from word elements. For example, the knowledge that the second component of a compounding word is usually the head noun modified by the first component may help the learner exclude a wrong guess such as "to eat the moon" from candidates for the meaning of the combination of "moon" and "to eat." The belief that the semantic contribution of word elements to the meaning of the whole word is not always straightforward may prevent the learner from overgeneralizing the rule of one instance to another word (e.g., "carrot cake" is a kind of cake that is made from carrots, but "coffee cake" or "angle cake" is not something made from coffee or an angle). Therefore, students' ability to use information from word components while interpreting novel words may be more closely related to their general verbal ability, their metacognitive beliefs about the efficacy of using information from internal word structures to interpret unknown words, and their ability to monitor their own guesses than to overall language proficiency.

In sum, the results of the present study indicate considerable individual differences among learners in their choice of the linguistic aspects to which they pay attention when multiple information sources are available. The findings also suggest that the tendency to overrely on one information source may be relatable to other factors besides language proficiency, such as learners' metalinguistic awareness of internal word structures and metacognitive beliefs about the efficacy of the learning strategies they use.

Conclusion and Implications

The present study addresses an issue of integration of information from the internal word structures and external contextual information in learning new words. Although the advantage of multiple information sources in vocabulary learning intuitively appeals to researchers and practitioners, the previous studies of English-speaking students had obtained no evidence that two information sources work together to yield greater gains in students' understanding of new words. This is partly because English derivational morphemes may be so transparent that the meaning of an unknown derivative can be easily determined by its elements without additional information from context.

In view of this limitation, this study examined English-speaking college students' abilities to integrate information from component characters and sentence contexts in interpreting novel kanji compounds that are logographic. In many kanji compounds, component characters do not necessarily make a direct contribution to the meaning of the whole word. Therefore, it was anticipated that external contextual information would be of help to determine the meanings of unknown kanji compounds. As expected, English-speaking JFL learners are more likely to obtain the exact meanings when they base their inference on both the component characters and contextual information than when rely on a single source of information. Hence, this finding is interpreted as evidence supporting the hypothesis proposed by Nagy and Anderson (1984) that information from internal word structures and external contextual information may work together to yield better understanding of novel words.

More importantly, the present study has shown (a) that information from word parts and contextual information are quantitatively different, and (b) that, because of this, guessing word meanings using the meanings of component characters requires a different ability from the ability to

infer from context. In addition, how much L2 learners gain from contextual information is, to a large extent, determined by their proficiency in Japanese, whereas the degree of the success with which they derive the meanings of unknown compounds using information from component kanji characters seems to be related to other factors, such as their metalinguistic awareness of the nature of words and their ability to monitor their own guesses.

No correlation between the ability to infer word meanings from morphological information and the ability to use contextual information could be interpreted as evidence that L2 learners show considerable individual differences in the linguistic aspects to which they pay attention when multiple information sources are available. In the present study, a considerable number of JFL learners show a tendency to overrely on component characters, while another group appear to overrely on contextual information. One possible direction for future research is to explore factors that may influence L2 learners' choice of strategies in interpreting unknown words when faced with multiple information sources.

One pedagogical implication drawn from the advantage of learning new words from multiple information sources is that encouraging students to pay attention to as many information sources as possible and to integrate them could enhance learners' vocabulary growth in both L1 and L2. As the results of this study have shown, surrounding context provide information that component characters do not provide and vice versa. Language instructors, therefore, could teach students that because their guesses generated solely by information from word elements are very likely to be different from what they would infer from surrounding contexts, they should always check their guesses against other sources of information. Research suggests that students are able to improve their ability to use contextual information by receiving such strategy instruction (Graves & Buikema, 1990; Herman & Weaver, 1988). In addition, students who tend to overrely on a single source of information must be taught how to use other strategies for interpreting unknown words.

Given the fact that students receive limited linguistic input in the classroom, such metacognitive instruction aimed at guiding them to become independent, effective, and persistent learners may eventually help them to increase their linguistic knowledge on their own. In fact, practitioners and researchers argue that teaching advanced learners strategies for handling unknown words on their

own is more important than teaching them the words themselves (Kang & Golden, 1994; Nation, 1990). Effective learning strategies are teachable (Weinstein & Mayer, 1986) and essential in "self-regulated learning"[3] (Zimmerman, 1989). Findings from L1 and L2 vocabulary acquisition research should provide teachers and researchers with significant insights into the strategies that should be taught.

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Table 1

Means and Standard Deviations of Proportions of the Four Answer Types in the Three Conditions (All Students)

		Answer Type							
		Right		Kanji		Context		Wrong	
Condition	n	M	SD	M	SD	M	SD	M	SD
1 Kanji and Context	59	.72	.13	.14	.11	.13	.08	.01	.03
2 Kanji Only	59	.47	.12	.40	.12	.09	.05	.04	.05
3 Context Only	59	.57	.15	.05	.05	.35	.12	.03	.04

Table 2

The Combinations of the Three Conditions and the Four Answer Types

		Answer Type			
	Condition	Right	Kanji	Context	Wrong
1	Both	r1	k1	c1	w1
2	Kanji Only	r2	k2	c2	w2
3	Context Only	r3	k3	c3	w3

Table 3

Definitions of the Integration and Non-Integration Measures Used in Study One

Abbreviation	Definition	Interpretation
Integration Measure		
r1	Proportion of Right Answers in the Both Condition.	Students integrated information from word parts and context
Kanji Measures		
r2	Proportion of Right Answers in the Kanji Only Condition.	Students used information from component characters
k2	Proportion of Kanji Distracters in the Kanji Only Condition.	Students used information from component characters
r2+k2	Summation of r2 and m2	Correct answers for Kanji Only Cond.
Context Measures		
r3	Proportion of Right Answers in the Context Only Condition.	Students used information from sentence contexts
c3	Proportion of Context Distracters in the Context Only Condition.	Students used information from sentence contexts
r3+c3	Summation of r3 and c3	Correct answers for the Context Only Condition
Non-Integration Measures		
k1	Proportion of Kanji Distracters in the Both Condition.	Students overrelied on information from word parts
c1	Proportion of Context Distracters in the Both Condition.	Students overrelied on contextual information

Table 4

Correlations Between Integration and Non-Integration Measures[a]

	Integration	Kanji			Context			Non-Integration	
	r1	r2	k2	r2+k2	r3	c3	r3+c3	k1	c1
Integration Measure									
r1	1.00								
Kanji Measures									
r2	.30*	1.00							
k2	-.19	-.79**	1.00						
r2+k2	.19	.39**	.22	1.00					
Context Measures									
r3	.27	.21	-.28	.03	1.00				
c3	-.12	-.17	.21	-.00	-.89**	1.00			
r3+c3	.34*	.11	-.24	.14	.53**	-.13	1.00		
Non-Integration Measures									
k1	-.82**	-.26	.26	-.01	-.26	.08	-.41**	1.00	
c1	-.59**	-.23	-.02	-.30*	-.09	.11	-.01	.10	1.00

[a]See Table 3 for the definitions and the interpretations of the measures used in this table.

*$p < .05$. **$p < .01$.

Table 5

Definitions of the Effect Measures Used in Study One

Abbreviation	Definition	Interpretation
Effect of Kanji		
r1-r3	Difference in the proportion of Right Answers between Both Cond. and Context Only Cond.	Indicates how much the proportion of Right Answers increases due to information from kanji.
c1-c3	Difference in the proportion of Context Distracters between Both Cond. and Context Only Cond.	Indicates how much the proportion of Context Distracters decreases due to information from kanji.
Effect of Context		
r1-r2	Difference in the proportion of Right Answers between Both Cond. and Kanji Only Cond.	Indicates how much the proportion of Right Answers increases due to contextual information.
k1-k2	Difference in the proportion of Kanji Distracters between Both Cond. and Kanji Only Cond.	Indicates how much the proportion of Kanji Distracters decreases due to contextual information.

Table 6

Correlations Between the Effect Measures[a]

	Effect of Kanji		Effect of Context	
	r1-r3	c1-c3	r1-r2	k1-k2
Effect of Kanji				
r1-r3	1.00			
c1-c3	-.81**	1.00		
Effect of Context				
r1-r2	.44*	-.20	1.00	
k1-k2	-.38*	.09	-.81**	1.00

[a]See Table 5 for the definitions and the interpretations of the measures used in this table.

*$p < .05$. **$p < .01$.

Table 7

Correlations Between Integration and Non-Integration Measures and Proficiency Measures for the Pre-Advanced Group

	Integration	Kanji			Context			Non-Integration	
	r1	r2	k2	r2+k2	r3	c3	r3+c3	k1	c1
Midterm Exam	.55*	.23	-.26	.09	.41*	-.32	.34	-.57*	-.24
Final Exam	.58*	.11	-.13	.07	.37*	-.26	.38*	-.56*	-.32
Proficiency Test	.65*	.47*	-.46*	.20	.48*	-.36*	.47*	-.63*	-.54*

Note. n=24. Three students of the advanced group had taken the equivalent course in the previous year. Their midterm and final exam scores were adjusted on the basis of the means and the standard deviations of the exam scores of the two years.

*$p < .05$.

Table 8

Correlations Between Effects of Kanji and Context and Proficiency Measures for the Pre-Advanced Group

	Effect of Kanji		Effect of Context	
	r1-r2	c1-c3	r1-r2	k1-k2
Midterm Exam	.14	.17	.25	-.54*
Final Exam	.19	.07	.37*	-.51*
Proficiency Test	.16	.03	.14	-.47*

Note. n=24. Three students of the advanced group had taken the equivalent course in the previous year. Their midterm and final exam scores were adjusted on the basis of the means and the standard deviations of the exam scores of the two years.

*$p < .05$.

Notes

[1]According to the Kokuritsu Kokugo Kenkyujo (The National Language Institute in Japan) report on the vocabulary of magazines (1964), the percentage of total word count are 53.9% for Japanese native words, 41.3% for Sino-Japanese words, 2.9% for foreign words, and 1.9% for hybrid words. Since native words are often presented in kanji or in the combination of kanji and hiragana, a syllabary used in Japanese, the proportion of kanji words is much higher than 41.3%.

[2]For the sake of presentation, the Japanese words and sentences in these examples are presented in the English alphabet. English translation for component characters and target sentences and answer types are also given in the parentheses for readers' convenience. In the test given to participants, all target compounds and sentences are presented in Japanese and no sentence translation was given.

[3]In Zimmerman (1989), self-regulated learning is defined as a types of learning in which "students personally initiate and direct their own efforts to acquired knowledge and skill rather than relying on teachers, parents, or other agents of instruction" (p. 329).